DOCUMENT RESUME

ED 240 376 CE 038 333

AUTHOR Hill, Pamela
TITLE Engine Identification. Teacher's Guide. Small Engine Repair Series.
INSTITUTION East Texas State Univ., Commerce. Occupational Curriculum Lab.
SPONS AGENCY Texas Education Agency, Austin. Dept. of Occupational Education and Technology.
PUB DATE 82
NOTE 76p.; For related documents, see ED 146 392, ED 221 760-767, ED 222 717, ED 223 907-911, and CE 038 334-335.
AVAILABLE FROM Occupational Curriculum Laboratory, East Texas State University, Commerce, TX 75428 (Order No. TI-198).
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Audiovisual Aids; Behavioral Objectives; *Disabilities; *Engines; Learning Activities; *Learning Disabilities; *Mental Retardation; Scripts; Secondary Education; *Small Engine Mechanics; Student Evaluation; Teaching Guides; *Trade and Industrial Education; Transparencies

ABSTRACT

This teacher's guide is part of an instructional series on small engine repair that is intended for use with mentally retarded and learning disabled students in general mechanical repair programs. The package also includes three student manuals. Notes to the instructor cover equipment needed, preparation before teaching, and use of evaluation charts, transparency masters, audiovisual(s), and student manuals. Other contents include a list of prerequisite skills, a chart of student goals and objectives, activities and materials to achieve them, a list of vocabulary terms, 21 transparency masters, answers to review materials in the student manual, an evaluation model, narratives for two audiovisual presentations, and a reference list. (This material has been developed as an extension of Comprehensive Small Engine Repair--ED 146 392--published by the Mid-American Vocational Curriculum Consortium, Inc. It is recommended that the two be used together.) (YLB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

ED240376

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

D Bristow

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

SMALL ENGINE REPAIR SERIES

ENGINE IDENTIFICATION

Teacher's Guide

Prepared by Pamela Hill

Published by
Occupational Curriculum Laboratory
East Texas State University
Commerce, Texas 75428

in cooperation with
Texas Education Agency
Occupational Education and Technology
Austin, Texas 78701

FIRST EDITION
1982

Frances Hyatt
EDITOR

Bob Norsworthy
ART DIRECTOR

Brand names, company names, trademarks, or other identifying symbols appearing in the text are used to clarify and identify and do not constitute a recommendation or endorsement.

ETSU, an Equal Opportunity University, complies with all federal requirements prohibiting discriminatory activities.

TEACHER'S GUIDE FOR ENGINE IDENTIFICATION

TABLE OF CONTENTS

	PAGE
PREFACE	v
ACKNOWLEDGMENTS	vii
NOTES TO THE INSTRUCTOR	1
STUDENT PREREQUISITE SKILLS	5
STUDENT GOAL AND OBJECTIVES	7
VOCABULARY TERMS FOR ENGINE IDENTIFICATION	11
TRANSPARENCY MASTERS	13
TM-1: Small Gas Engine Parts	
TM-2: Nameplate Information	
TM-3: Characteristics of a 4-Stroke Cycle Engine	
TM-4: Characteristics of a 2-Stroke Cycle Engine	
TM-5: Vertical Operating Position of Crankshaft	
TM-6: Horizontal Operating Position of Crankshaft	
TM-7: Multi-position Crankshaft	
TMs 8-20: Safety to Follow	
TM 21: Tools and Equipment for Checking the Oil and Fuel Levels	
ANSWERS TO REVIEW MATERIAL IN THINGS FOR YOU TO KNOW	55
EVALUATION MODEL	59
NARRATIVES FOR AUDIOVISUAL PRESENTATIONS	61
Check Oil and Fuel Levels	
Start, Adjust, and Stop the Engine	
REFERENCES	73

PREFACE

ENGINE IDENTIFICATION, an instructional package in the Small Engine Repair series, was developed, field-reviewed, and evaluated by vocational industrial teachers who teach handicapped students about repairing small engines. This material was developed as an extension of Comprehensive Small Engine Repair by the Mid-America Vocational Curriculum Consortium, Inc., and we recommend the two be used together.

This project, now in its third year, was initiated in 1979 because it was felt that special needs students enrolled in General Mechanical Repair programs in Texas needed more appropriate instructional materials to aid their learning. The aim of this project has been twofold: (1) To task analyze the typical repair jobs of small engines and then identify the minimum required information, safety, and work habits associated with each repair job; and (2) To present this material in a variety of ways that are consistent with learning styles of special needs students with cognitive dysfunctions--primarily, the mentally retarded and learning disabled.

ENGINE IDENTIFICATION is designed with a combination of different media approaches--audio, visual, and hands-on. It is anticipated that this balanced multimedia approach will not only provide an opportunity for students to experience learning from different angles, but will also make learning more interesting and easier. Included in ENGINE IDENTIFICATION are the following instructional materials:

Audiovisuals:

1. Check The Oil and Fuel Levels (4-stroke cycle engines)
2. Start, Adjust, and Stop the Engine (with different kinds of choke systems)

Student Manuals:

Introduction: Things For You To Know
1. Check the Oil and Fuel Levels (4-stroke cycle engines)
2. Start, Adjust, and Stop the Engine (with different kinds of choke systems)

Teacher's Guide: ENGINE IDENTIFICATION

Audiovisuals

The two audiovisual presentations portray the two most frequently performed jobs in a small engine repair shop. The presentations are available in either filmstrip/cassette or slide/cassette style. They are short and concise, with simplified steps of the jobs to hold the interest of the special needs learner.

Designed to be used in both group and individual instruction, the audiovisuals may be used as a class presentation before or after "hands-on" demonstration of the repair job. If repetition is needed in order for a student to learn the steps of a job, the presentation may also be viewed individually without teacher assistance. For the student who is an auditory learner or blind, listening to the cassettes will be an important aid in that student's ability to learn the repair jobs.

Student Manuals

Accompanying ENGINE IDENTIFICATION are three student manuals. These contain numerous illustrations and pictures, with written material on a low reading level. Each manual has its own performance objective and evaluation chart so that the students can understand what is expected and rate their own progress toward achieving the objective.

Information in Things For You To Know is given in small, sequential segments so that the students are not overwhelmed with the amount of information to be learned. With the short review sections, titled "How Much Do You Remember?" the students can individually learn the information that is grouped together before going on to the next segment of information.

Material covered in Things For You To Know is considered to be the minimum information that a student needs to know about engine identification in order to get a small engine repair job. However, it is recommended that the teacher refer to the unit on Engine Identification and Inspection in Comprehensive Small Engine Repair.

Student Manuals 1 and 2 explain in pictures and short sentences the two most frequently performed jobs on small engines. Among the steps of each job, specific safety and caution information is frequently noted throughout the manuals. To reinforce consistency in material presented to the slow learner, the pictures and written words correspond exactly with the pictures and wording on the audiovisual presentations.

The three student manuals may be used in several different ways. They may be used as a picture manual by the student, who can look at the pictures while learning the information or doing the steps of the job; they may be used as reading material to reinforce reading skills; or they may be used by the teacher to help explain information or parts of the job that are difficult to understand or see during hands-on demonstration.

Teacher's Guide

The Teacher's Guide was developed with one thought in mind--to help the teacher provide successful learning experiences for the special needs student. Student prerequisite skills have been identified to give the teacher the option of teaching these skills before or during the presentation of ENGINE IDENTIFICATION. Objectives are arranged so that they may help the teacher develop Individual Instructional Plans (IIPs). Additional resource material, such as the vocabulary terms, transparency masters, and audiovisual narratives, are given to support the variety of teaching methods.

ENGINE IDENTIFICATION may be purchased as an individual instructional package of the Small Engine Repair series, and additional student manuals may be purchased separately.

For further information or comment on ENGINE IDENTIFICATION or the Small Engine Repair series, contact the Occupational Curriculum Laboratory, East Texas State University, Commerce, Texas 75428.

ACKNOWLEDGMENTS

Recognition for the successful development of ENGINE IDENTIFICATION is given to the Industrial Employers and Teachers Advisory Committee who conscientiously gave of their knowledge and time. Special thanks is extended to the following advisory members, most of whom have served on this committee for two years.

Charles Francis	Briggs-Stratton Rep.	Wahlburg-McCreary, Inc. Houston
Don Talley	Talley Auto Parts Co.	Commerce
Bill Gray	Bill's Saw Shop	Greenville
Owen Hill	VEH-GMR	El Paso ISD
Pedro Ruiz	CVAE-GMR	Big Spring ISD
Gary Stephens	CVAE-GMR	Hurst-Euless-Bedford ISD
Thaddeus Curry	VEH-GMR	Klein ISD
Robert Svetlik	CVAE-GMR	Hallettsville ISD
Robert Katzer and Bob Warren	CVAE-GMR	San Marcos ISD
Larry Kilbreth	CVAE-GMR	Pampa ISD
Jesse Swindle	CVAE-GMR	North Lamar ISD
Rex Davis	CVAE-GMR	Newton ISD
Fred Grimm	CVAE-GMR	Belton ISD
Vernon McGee	CVAE-GMR	Goose Creek ISD
Chuck Piggott	CVAE-GMR	Lyeford ISD
William Maroney	CVAE-GMR	Alamo Heights ISD

Appreciation is also given to those General Mechanical Repair instructors who field-reviewed ENGINE IDENTIFICATION at area in-service meetings in Texas. Their supportive comments, enthusiasm, and suggestions for changes were most valuable in the completion of this project.

The project staff is also indebted to Dr. Max Plata of the Special Education Department, East Texas State University, who assisted in the development of the format for these instructional materials.

Special appreciation is extended to Tom Hill, Vocational Adjustment Coordinator, Commerce ISD, who arranged for some of the vocational students in his class to serve as models in the audiovisual presentations, and who provided valuable insight for assuring that the final product be as realistic and job-oriented as possible for special needs students.

NOTES TO THE INSTRUCTOR

EQUIPMENT NEEDED

Before using this presentation, arrange to have the following equipment available:

Projector (either carousel slide or filmstrip type)
Carousel tray, if using slides
Projector screen
Cassette recorder
Overhead projector and other equipment necessary for making transparencies
Tools and 4-stroke-cycle gas engines for student use

PREPARATION BEFORE TEACHING THIS INSTRUCTIONAL PACKAGE

Before you begin teaching this instructional package, there are some things you should do:

1. Preview all instructional materials provided (Teacher's Guide, student manuals, and audiovisual presentations). Determine how these will be used in your class.

2. Assess each student for the Student Prerequisite Skills before introducing the instructional package. These prerequisite skills are provided in this guide.

3. Gather additional resources necessary to teach the prerequisite skills to those students who are deficient.

4. Teach the prerequisite skills to those students who need them.

This will help ensure successful learning of ENGINE IDENTIFICATION by each student.

STUDENT GOAL AND OBJECTIVES

The student goal and objectives for this instructional package are provided on page 7. These are to assist you in writing each student's Individual Instructional Plan (IIP). The student goal and objectives are also given to the student at the beginning of each student manual. They are titled "The Point of This Booklet" and "What You Will Have to Know and Do." The goal and objectives have been reworded at a level which is understandable to the student.

1. Discuss the goal and objectives with each student so that it is clearly understood what is expected of the student.

2. Add any additional objectives such as the prerequisite skills which need to be learned by the student.

EVALUATION CHARTS

It is encouraged that a grading system not be based on a written test, but rather on individual physical performance of the objectives by each student. Evaluation charts are provided at the end of each student manual. The charts are intended for use as grading instruments and as motivational aids by rating personal progress toward the objectives.

1. Discuss with the students how they will be evaluated, based on individual performance shown by the evaluation charts.

2. See the section titled "Evaluation Model" for specific instructions on how to use the evaluation charts.

TRANSPARENCY MASTERS

Numerous 8½" x 10" illustrations have been provided in the Teacher's Guide to be used in a variety of ways:

1. As transparencies. If so, make an acetate of each illustration so that it may be projected onto a screen, using an overhead projector.

2. Copied and used as hand-outs to students.

3. As review activities; i.e., students are asked to identify items on an illustration in which the names of parts have been erased.

4. As display material for a bulletin board.

INTRODUCTION: THINGS FOR YOU TO KNOW

1. Before introducing the two jobs of this instructional package, first teach the minimum information, safety, and good work habits that are presented.

2. For those students who are able to read and benefit from the activities, provide them with their own manual.

3. Using the transparencies and any additional resource material, teach the information provided in small, sequential steps.

4. Reinforce the learning of this information by having the student complete the activities in the section, "How Much Do You Remember?"

5. Frequently review the information to be learned in short, 15-minute practice sessions that can be spaced throughout other shop activities.

6. Provide for over-learning by giving the student additional reinforcement activities.

7. Make sure the student has mastered previously taught information before introducing new information to be learned.

8. Share with the student's special education teacher Things For You To Know, the transparencies, and the vocabulary terms so that this information can be reinforced with the student.

AUDIOVISUALS AND STUDENT MANUALS 1 AND 2

1. When introducing each of the jobs of this instructional package, use a combination of teacher demonstration, viewing of the audiovisual presentation, and student hands-on experience with a four-stroke-cycle gas engine.

2. Present the steps to each job in small, sequenced amounts so that each step is mastered by the student.

3. Have the student who needs additional help view the audiovisual presentation while doing each step of the job on an engine. This can be accomplished by having the student manually advance the cassette and projector once a previously viewed step has been completed by the student on an engine.

4. For those students who are visual learners or able to read on a 4.5 grade reading level, provide them with their own Student Manuals 1 and 2.

5. As the jobs are taught and the students practice learning the steps, have the students rate their progress using the evaluation charts found in the back of the student manuals.

6. Share with the student's special education teacher Student Manuals 1 and 2 as reading reinforcement materials to be used by the student.

STUDENT PREREQUISITE SKILLS

Listed below are prerequisite skills which the student needs in order to successfully learn the 2 basic jobs associated with engine identification. It is recommended that the instructor teach these skills before or during the student learning of this instructional package.

PREREQUISITE SKILLS	SUGGESTED ACTIVITIES
1. Demonstrates a working knowledge of commonly used vocabulary terms associated with engine identification.	Discuss "Vocabulary Terms" provided in the Teacher's Guide; use the "Vocabulary Terms" as a transparency and student handout; provide student drills on the terms; and other teacher-made reinforcement activities.
2. Demonstrate proper use and safety of the following tools and equipment. small gas engine gasoline in approved gas can motor oil oil spout funnel shop towels	Use Transparency Masters 8-21 on "Safety to Follow" and "Tools for Check the Oil and Fuel Levels," and any additional resource material on safety with small gas engines and tools.

STUDENT GOAL AND OBJECTIVES

The following are provided to assist in the development and writing of each student's Individual Instructional Plan (IIP). Built into these objectives is the use of the evaluation charts found at the end of each student manual. You will want to use these charts for monitoring each student's progress toward these objectives. Criterion for competency or the rating that a student must achieve for a predetermined length of time is suggested as a rating of 3 for three consecutive days on the evaluation charts. See "Evaluation Model", page 61, for further information.

LONG-TERM GOAL: After completing ENGINE IDENTIFICATION, the student will be able to identify basic engine information and demonstrate safety, good work habits, and 2 jobs on a 4-stroke cycle small gas engine which are necessary for employment as a small engine mechanic.

SHORT-TERM OBJECTIVES	ACTIVITIES AND MATERIALS
1. Given information about the small gas engine, the student will understand and explain the following information for three consecutive days: * Tell the purpose of the small gas engine * Identify small gas engine parts and tell their use * Identify information on an engine nameplate * Identify information in the operator's manual * Name and identify 2 types of small gas engines * Identify 3 operating positions of the crankshaft	1. Read or listen to information on engine identification in Things For You To Know. 2. Using transparency masters 1-7, Teacher's Guide, and the 2 types of small gas engines and 3 operating positions of crankshafts and various engines, participate in class discussions and drills on the information to be learned. 3. Answer the review sections on "How Much Do You Remember?" in Things For You To Know. 4. Using the chart, "What Do You Know About Engine Identification?" in Things For You To Know, rate the student's progress for two consecutive weeks, or until a rating of 3 is achieved for three consecutive days.

NOTE TO THE INSTRUCTOR: Teach each of the above subobjectives separately. Evaluate the student's ability to understand and explain the subobjective before introducing the next one.

SHORT-TERM OBJECTIVES	ACTIVITIES AND MATERIALS
2. Given information on safety and good work habits to follow, the student will demonstrate them most of the time for three consecutive days while learning the 2 basic jobs associated with engine identification.	1. Read or listen to information on "Safety to Follow" and "Good Work Habits to Follow," in Things For You To Know. 2. Using the transparency masters 8-20, Teacher's Guide, participate in class discussion on the importance of following the safety and good work habits. 3. Answer the review questions on "Safety and Good Work Habits: How Much Do You Remember?" in Things For You To Know. 4. Using the chart, "Can You Follow Safety and Good Work Habits?" in Things For You To Know, rate the student's progress for two consecutive weeks, or until a rating of 3 is achieved for three consecutive days.
3. Given a 4-stroke-cycle gas engine and the correct tools, the student will check the oil and fuel levels by correctly following all the steps without help for three consecutive days.	1. Observe the teacher checking the oil and fuel levels on a 4-stroke-cycle gas engine. 2. Watch the audiovisual presentation, "Check the Oil and Fuel Levels," and participate in class discussions on this job. 3. Using Student Manual 1, read the words or follow the pictures which describe the steps in checking the oil and fuel levels. 4. Using a 4-stroke-cycle gas engine and the correct tools, practice the steps in checking the oil and fuel levels. 5. Using the chart, "Can You Check the Oil and Fuel Level?" Student Manual 1, rate the student progress for two consecutive weeks.

SHORT-TERM OBJECTIVES	ACTIVITIES AND MATERIALS
	6. Repeat above activities (1 through 5) until a rating of 3 on the chart, "Can You Check the Oil and Fuel Level?" is achieved for three consecutive days.
4. Given a small gas engine and the correct tools, the student will start, adjust, and stop the engine by correctly following all the steps without help for three consecutive days.	1. Observe the teacher starting, adjusting, and stopping engines with different kinds of choke systems. 2. Watch the audiovisual presentation, "Start, Adjust, and Stop the Engine," and participate in class discussion on this job. 3. Using Student Manual 2, read the words or follow the pictures which describe the steps in starting, adjusting, and stopping the engine. 4. Using a small gas engine, practice the steps in starting, adjusting, and stopping the engine. 5. Using the chart "Can You Start, Adjust, and Stop the Engine?" in Student Manual 2, rate the student progress for two consecutive weeks. 6. Repeat above activities (1 through 5) until a rating of 3 on the chart, "Can You Start, Adjust, and Stop the Engine?" is achieved for three consecutive days.

VOCABULARY TERMS FOR ENGINE IDENTIFICATION

The following vocabulary terms are words that are frequently found throughout this instructional package. These terms and their definitions are provided to aid the student in developing a common language that is often used in the small engine repair classroom. For more vocabulary terms such as engine parts that are defined, refer to student manual, Introduction: Things for You to Know.

1. Adjust--to move a part of the engine to help make the engine start and run correctly. When you adjust the throttle cable or choke, you push it back and forth to either open or close the choke which lets fuel and air mixture into the cylinder.

2. Apply the workload--to put the engine to work; for example, a lawnmower cutting grass, a chain saw cutting wook, or a tractor tilling a garden.

3. Carbon monoxide--a poisonous gas that is given off in the exhaust of a running engine.

4. Caution--a warning that you should pay attention to and follow, or you may break a part of the engine or the tool you are working with.

5. Check--to look at something to see if it is broken.

6. Choke--(as in "choke the engine") to make the choke valve close in the carburetor, thus reducing the amount of air that mixes with the fuel and making the engine easier to start.

7. Compression stroke--is stroke 2 of the piston which moves upward in the cylinder, thus pushing the air/fuel mixture into a very small space called the combustion chamber.

8. Flammable--something that can easily catch fire and burn.

9. 4-stroke cycle--the piston in an engine makes four strokes to complete one cycle.

10. Fuel level--the amount of fuel found in the fuel tank of an engine.

11. Gun the engine--to quickly push the engine throttle all the way open so that the engine will run as fast as it can.

12. Idle speed--the slowest possible speed at which the engine can run without stopping.

13. Oil chart--a chart that lists different makes of engines and recommends different types and grades of motor oil for various weather temperatures.

14. Oil level--the amount of oil found in the crankcase of an engine.

15. Overfill--to fill something until it is fo full that it might run over the top.

16. Remove--to take something out of or off of the engine.

17. Safety tip--a warning that you should pay attention to and follow or you might get hurt.

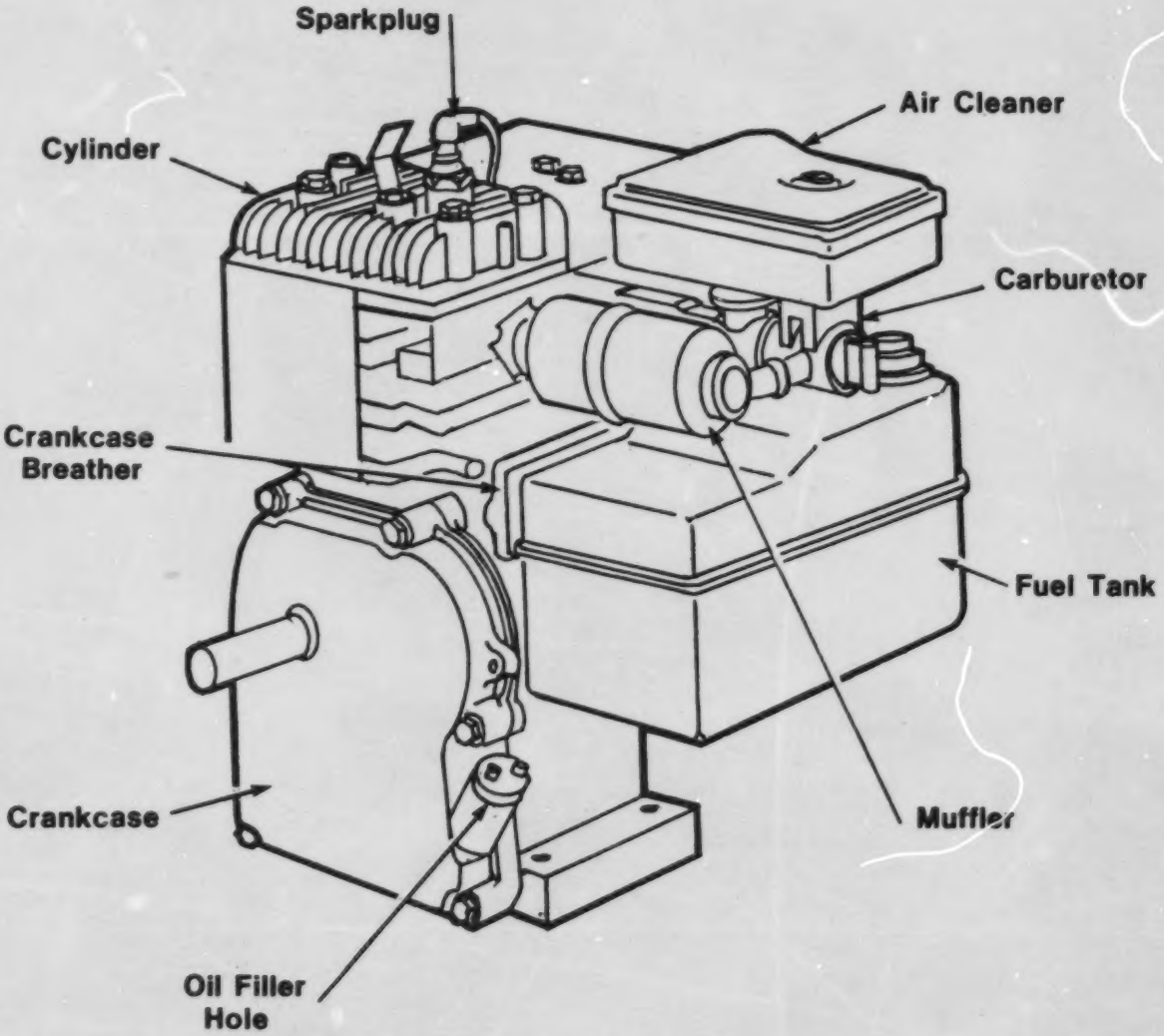
18. Slacken--(as in "slacken the rope") to lessen the tension or firmness in the rope by holding it loosely, not straight out or not pulling on it.

19. Sludge--a thick, muddy mixture of oil, dirt, and other deposits found in the engine sump and crankcase.

20. 2-stroke cycle--the piston in an engine makes two strokes to complete one cycle.

21. Well-ventilated--fresh air passes through a room and pushes out any fumes.

SMALL GAS ENGINE PARTS



TM-1

NAMEPLATE INFORMATION

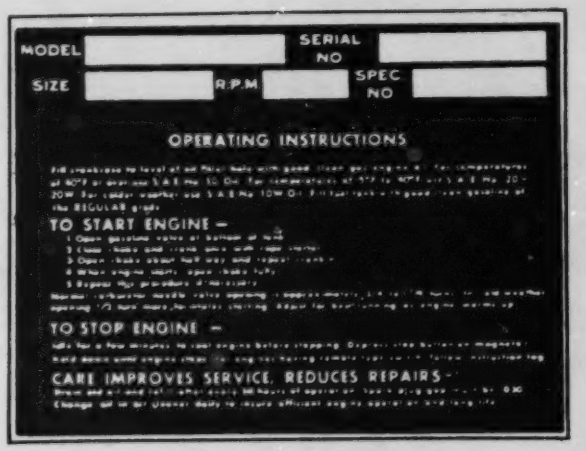
BRIGGS & STRATTON ENGINES

MODEL	SERIAL	TYPE
100202	19165	6B

READ INSTRUCTION BOOKLET BEFORE STARTING ENGINE.

OIL: SUMMER S.A.E. 30 WINTER S.A.E. 5W-20 GRADE "MS," "SC," OR "SD".

CLEAN AND RE-OIL AIR CLEANER ELEMENT REGULARLY



JACOBSEN ENGINE

FUEL MIXTURE

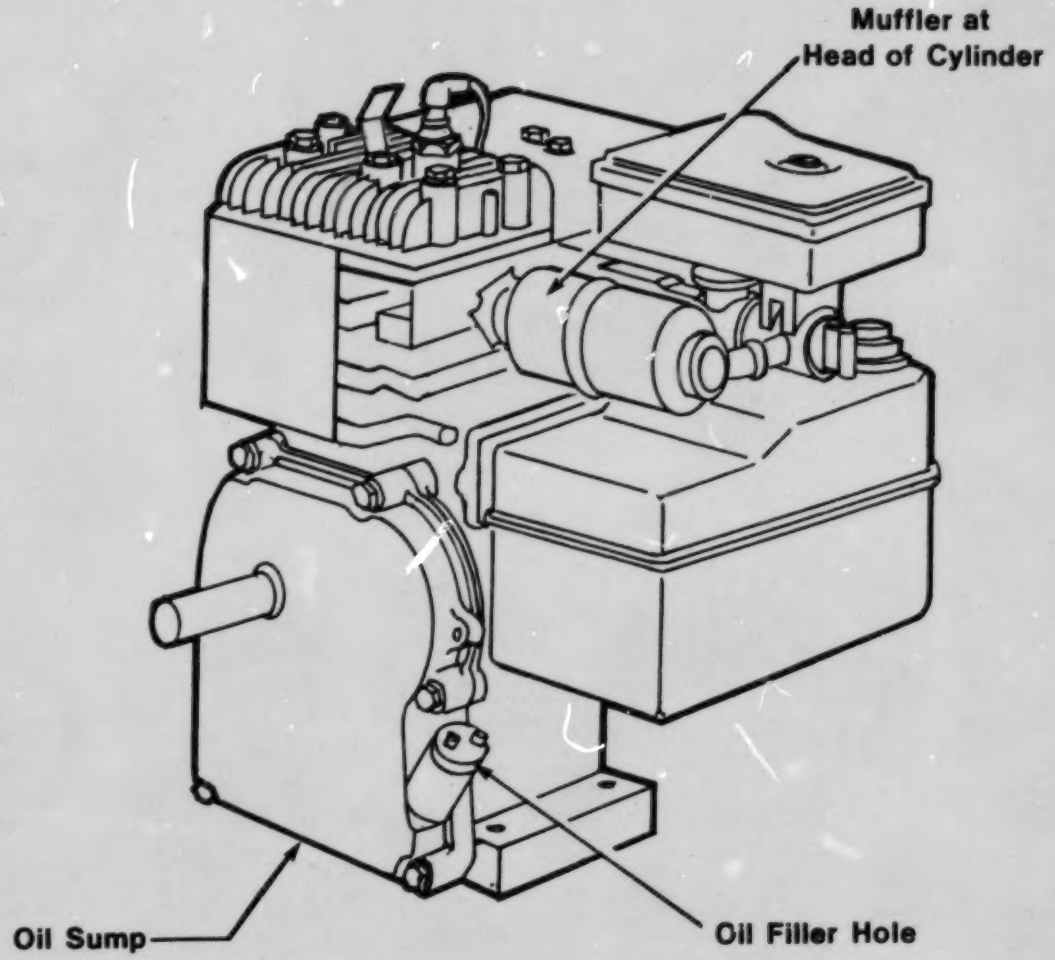
1 4 PINT JACOBSEN OR 10 1 GALLON REGULAR GASOLINE MIX THOROUGHLY

TO START ENGINE

1 DISENGAGE CLUTCH ON POWER PROPELLED MODELS
2 CHECK FUEL SUPPLY & OPEN FUEL TANK SHUTOFF VALVE
3 OPEN THROTTLE AND MOVE CHOKE LEVER TO CHOKE POSITION
4 GRASP STARTER HANDLE – PULL SLOWLY AND FIRMLY
5 WHEN ENGINE STARTS MOVE CHOKE TO RUN POSITION SEE MANUAL FOR ENGINE MAINTENANCE & ADJUSTMENTS

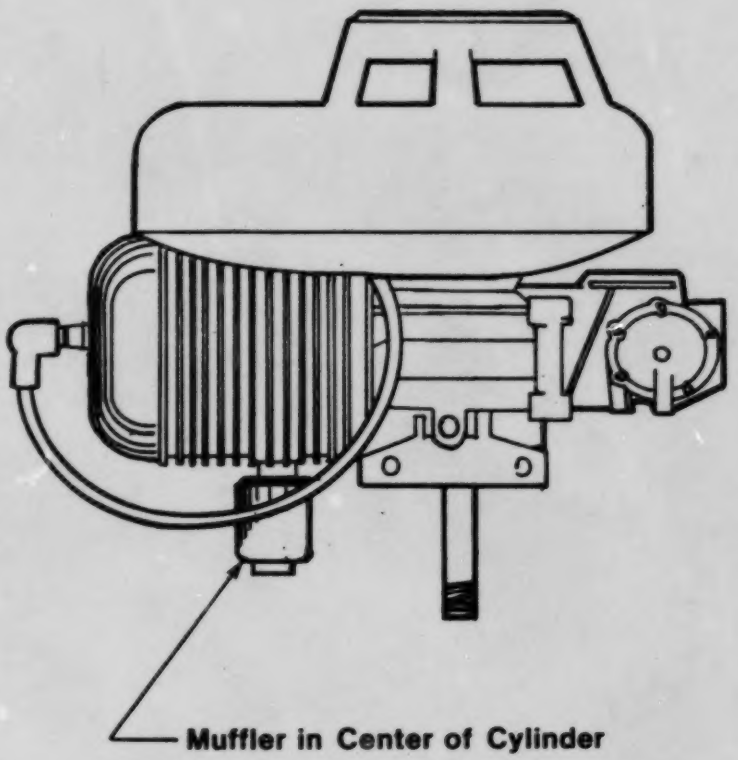
TM-2

CHARACTERISTICS OF A 4-STROKE CYCLE ENGINE

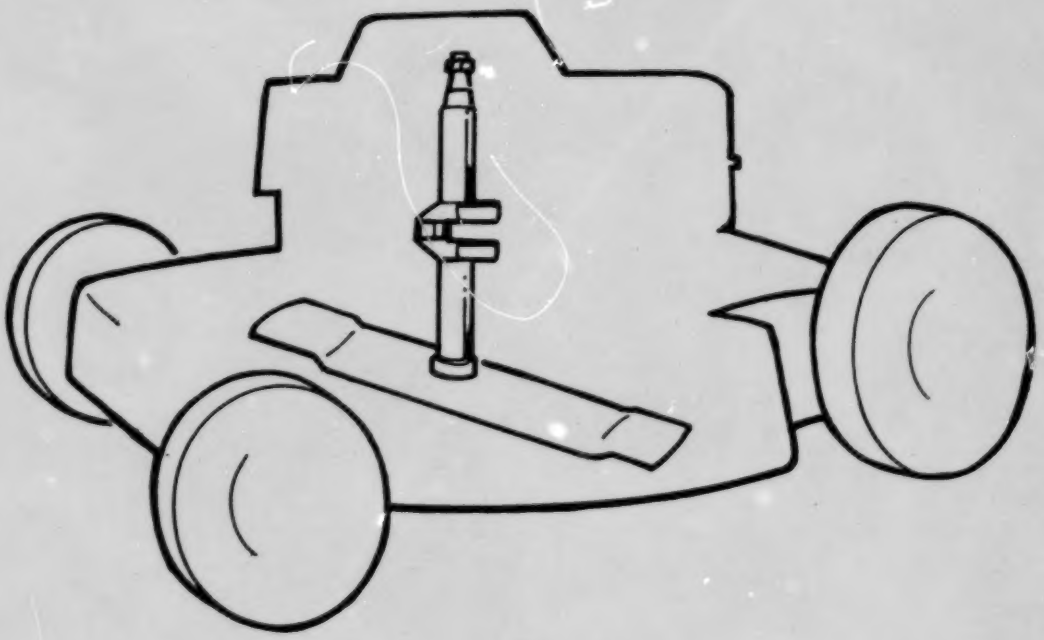


TM-3

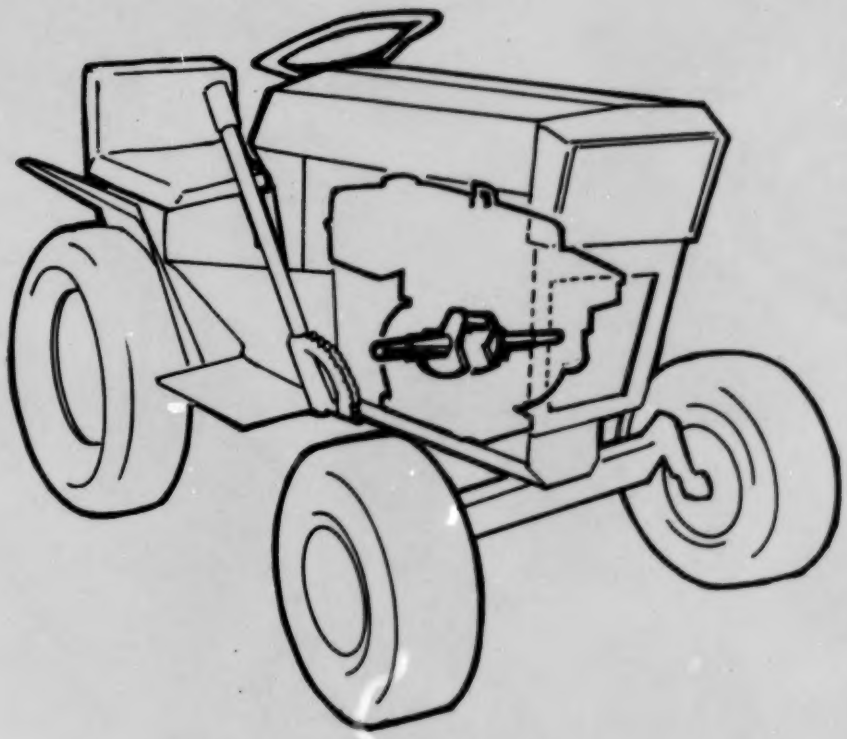
CHARACTERISTICS OF A 2-STROKE CYCLE ENGINE



VERTICAL OPERATING POSITION OF CRANKSHAFT

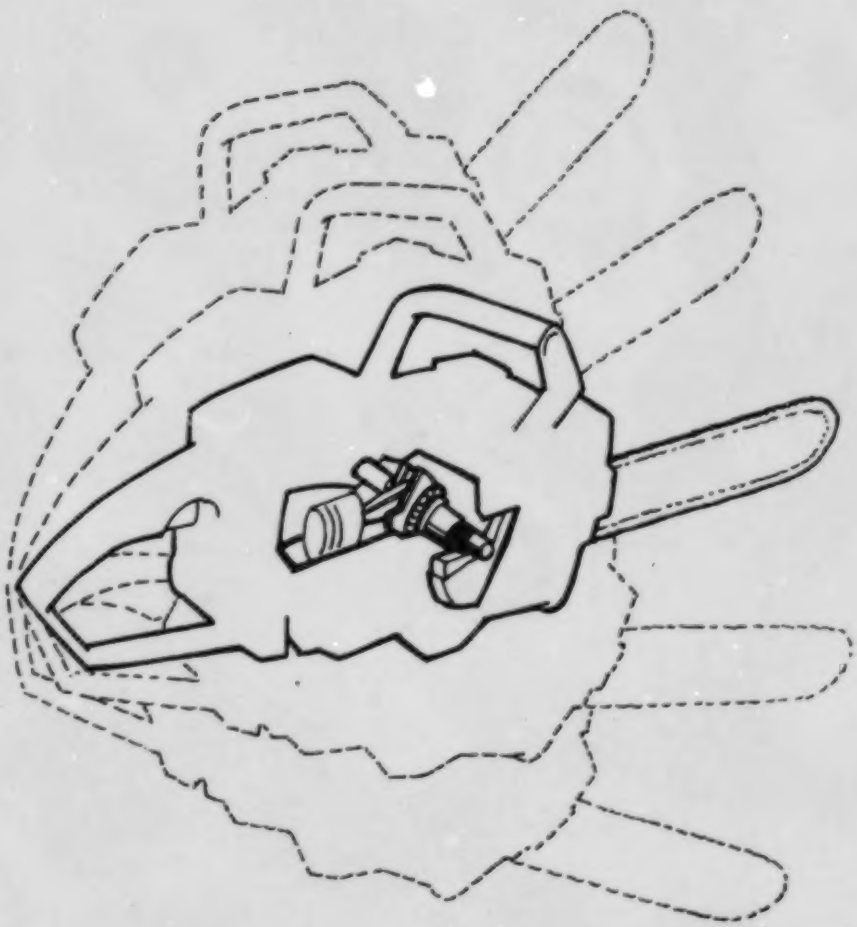


HORIZONTAL OPERATING POSITION OF CRANKSHAFT

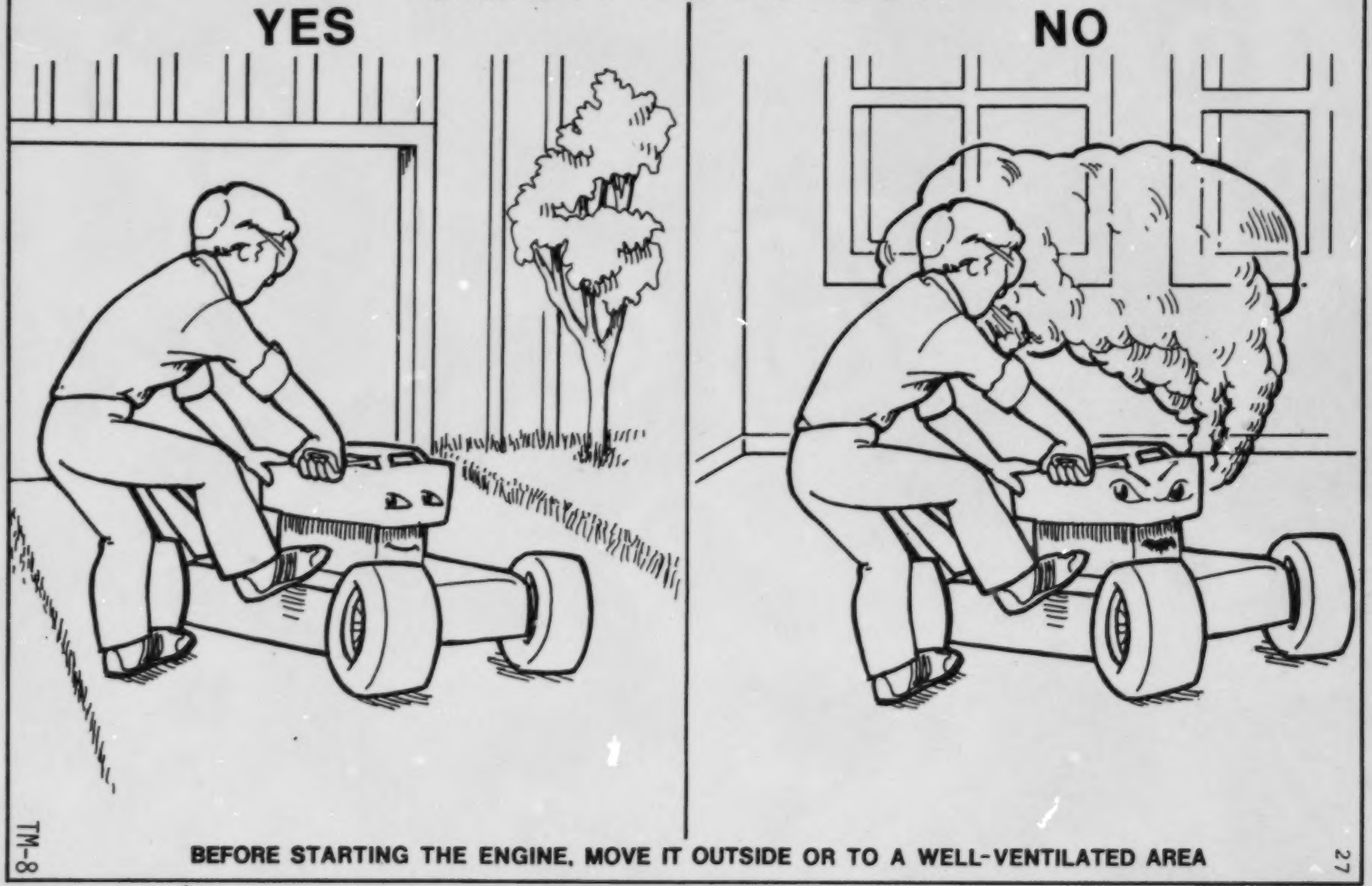


MULTI-POSITION CRANKSHAFT

25



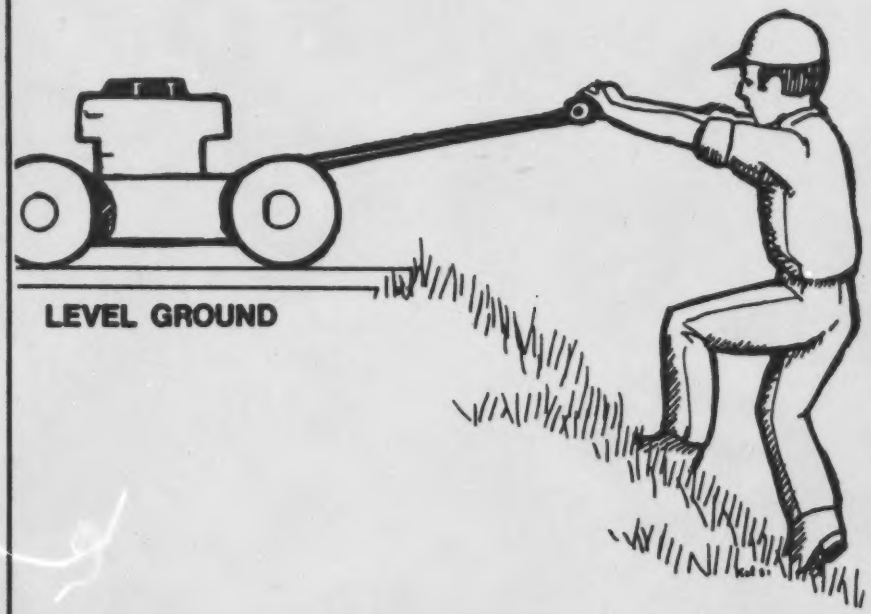
SAFETY TO FOLLOW



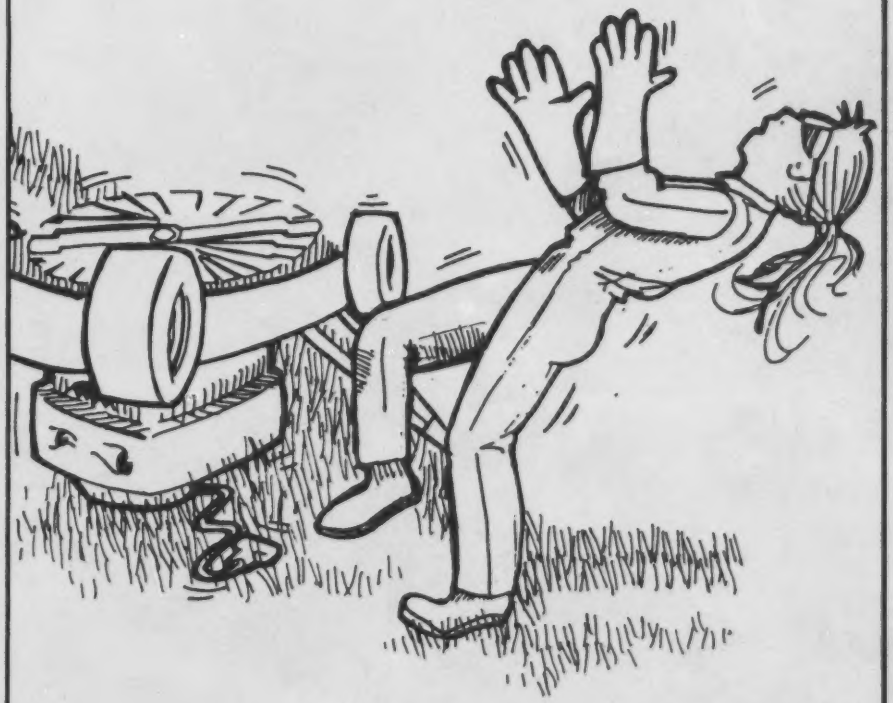
BEFORE STARTING THE ENGINE, MOVE IT OUTSIDE OR TO A WELL-VENTILATED AREA

SAFETY TO FOLLOW

YES



NO



BEFORE STARTING THE ENGINE, SEE THAT IT IS ON LEVEL GROUND.

TM-9

29

SAFETY TO FOLLOW

YES

NO

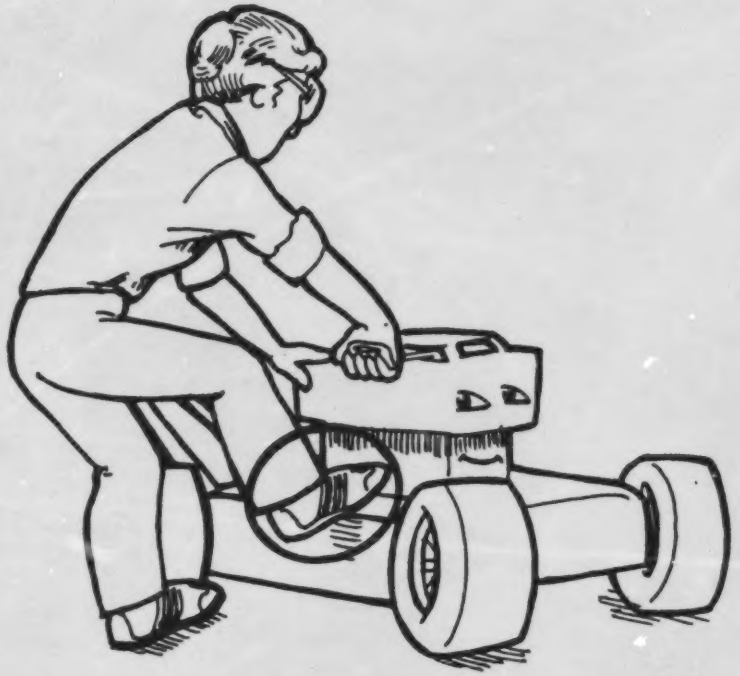
BEFORE STARTING THE ENGINE READ THE OPERATOR'S MANUAL OR ENGINE NAMEPLATE AND SEE HOW THE STOP SWITCH WORKS TO FIND OUT HOW TO START AND STOP THE ENGINE

TM-10

31

SAFETY TO FOLLOW

YES



NO

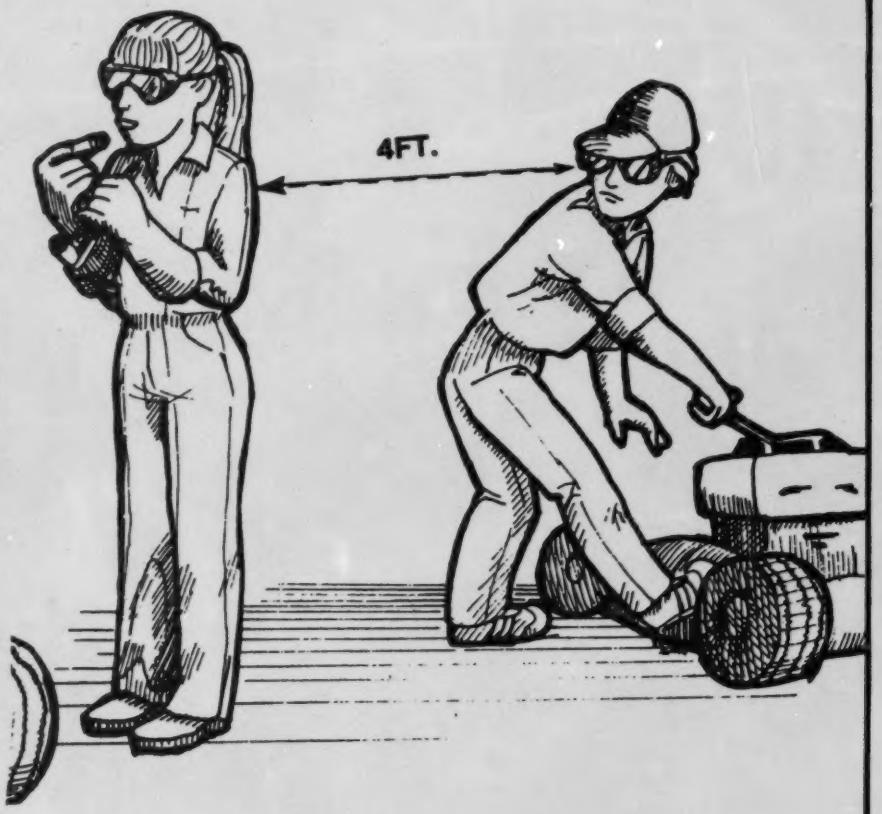
PUT ONE FOOT ON THE LAWNMOWER WHEN CRANKING THE ENGINE.

TM-11

33

SAFETY TO FOLLOW

YES



NO

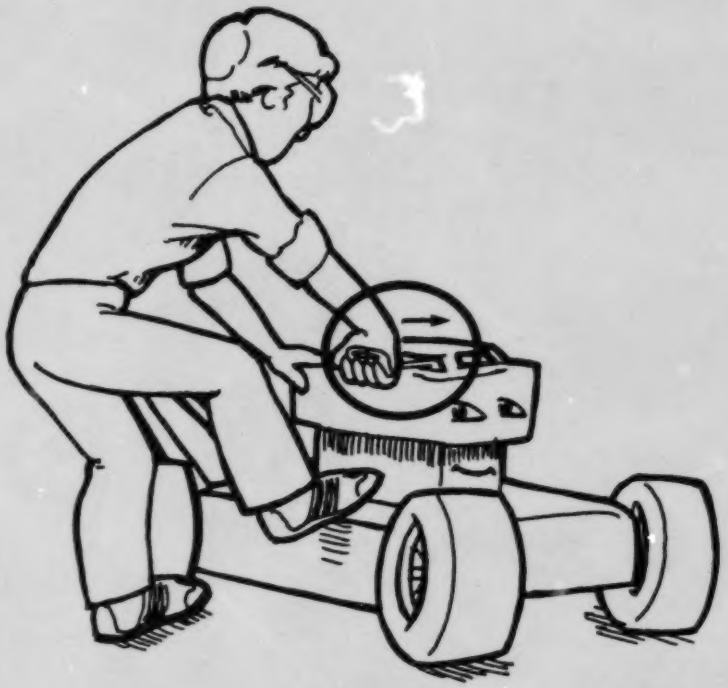
TM-12

LOOK BEHIND YOU BEFORE PULLING THE STARTER ROPE.

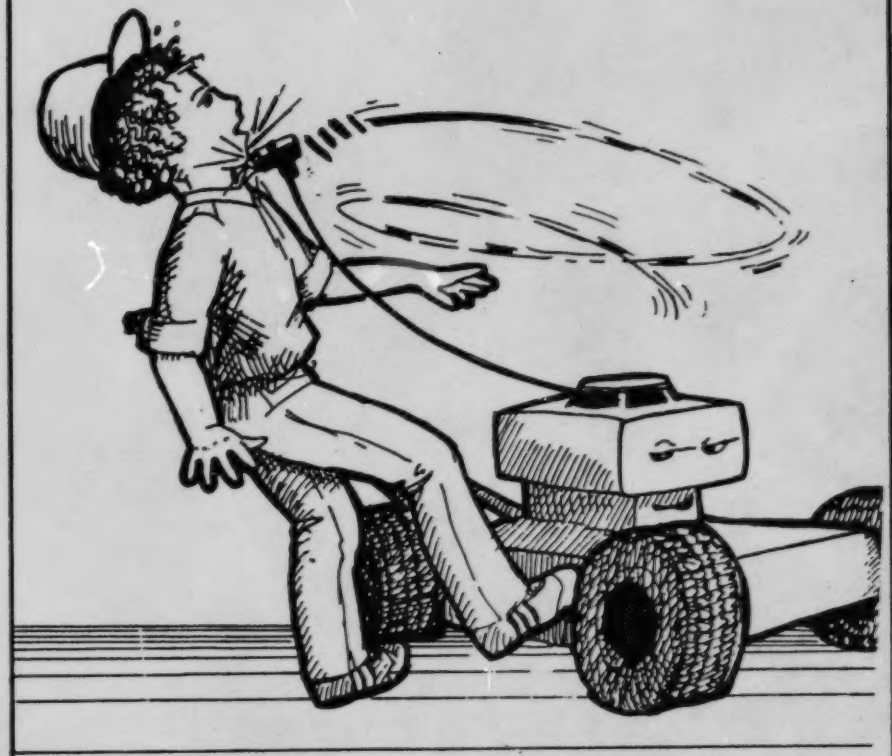
35

SAFETY TO FOLLOW

YES



NO



HOLD ON TO ROPE AS IT REWINDS ON TO PULLEY TO AVOID ACCIDENTAL INJURY

TM-13

37

SAFETY TO FOLLOW

YES

NO

TM-14

WHEN YOUR ENGINE RUNS OUT OF GAS ALWAYS STOP IT AND LET COOL BEFORE REFILLING TANK

39

SAFETY TO FOLLOW

YES

NO

DO NOT SMOKE OR LIGHT A MATCH NEAR OPEN FUEL TANK

TM-15

41

SAFETY TO FOLLOW

YES

NO

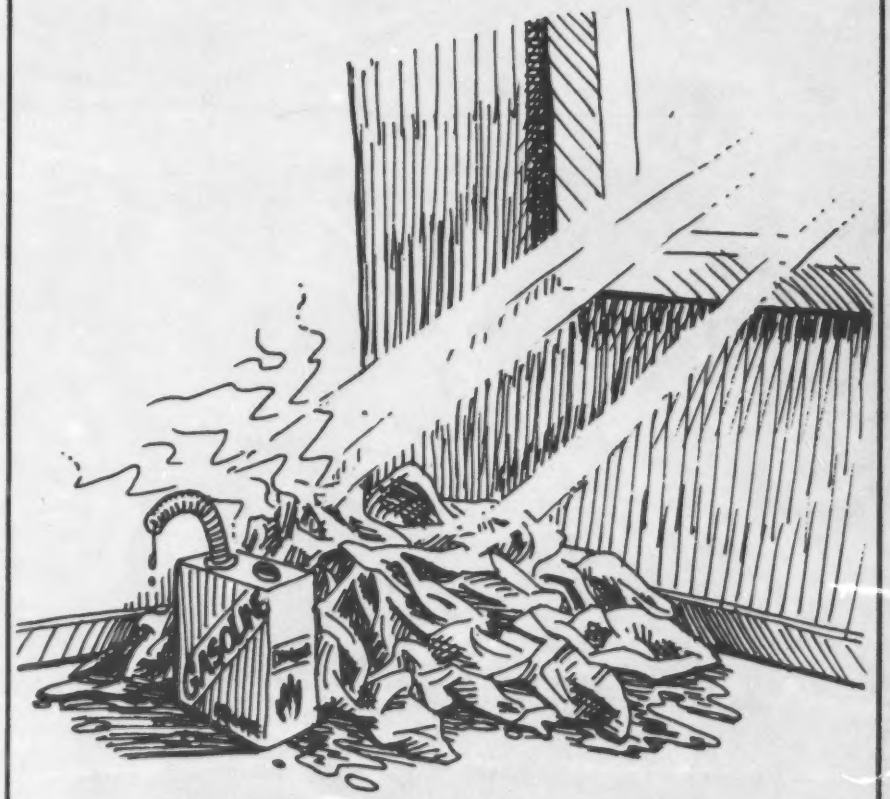
WIPE AWAY ANY SPILLED GASOLINE

TM-16

SAFETY TO FOLLOW

YES

NO



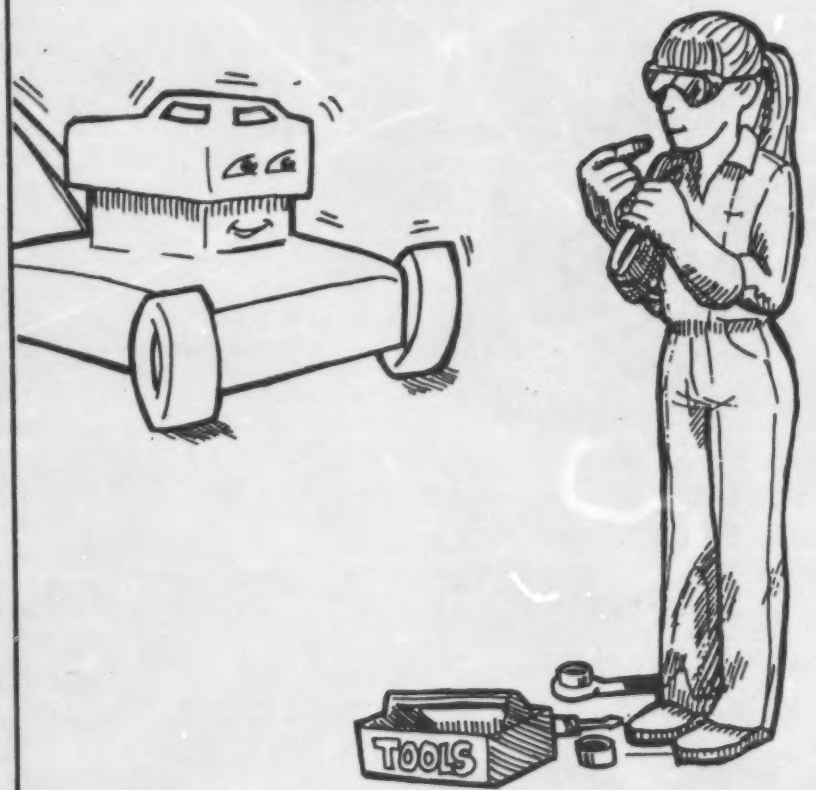
PUT OILY TOWELS IN AN APPROVED METAL CAN AND STORE GASOLINE IN A COOL DRY PLACE

TM-17

45

SAFETY TO FOLLOW

YES



NO

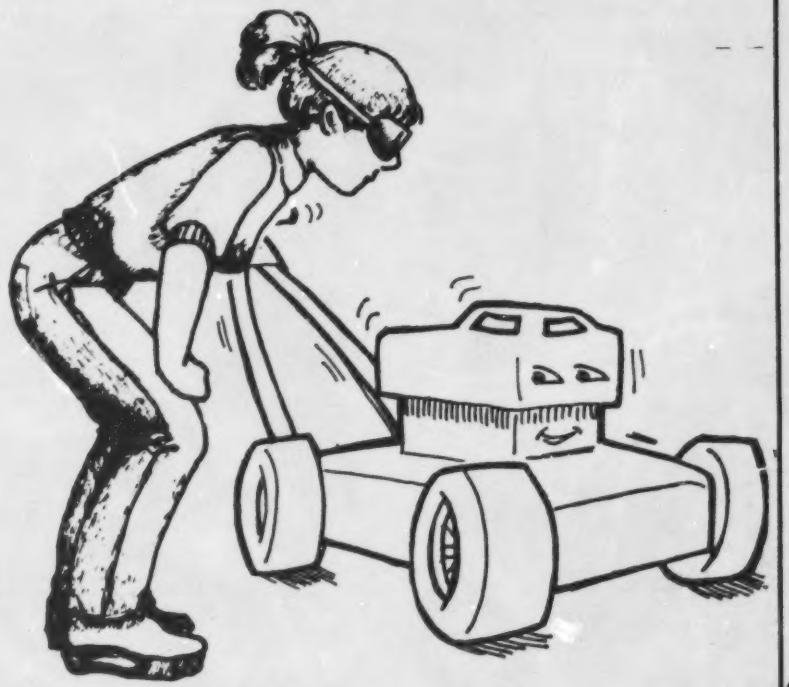
TM-18

WHEN AN ENGINE IS RUNNING, KEEP TOOLS AWAY FROM MOVING PARTS.

47

SAFETY TO FOLLOW

YES



NO

ALWAYS WATCH A RUNNING ENGINE. DO NOT LEAVE IT RUNNING UNATTENDED.

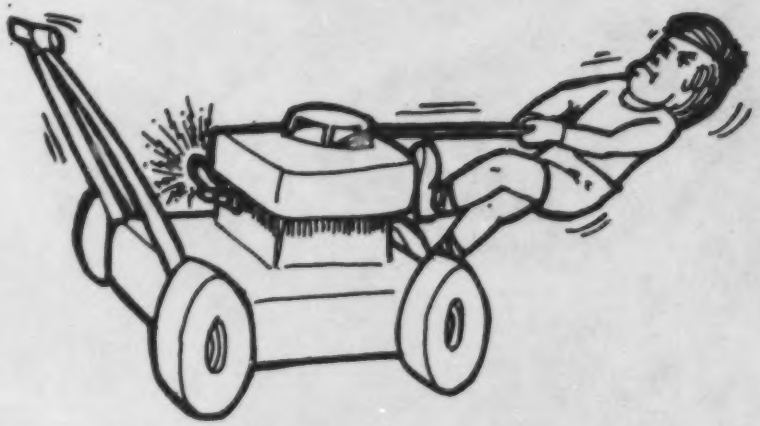
TM-19

49

SAFETY TO FOLLOW

YES

NO



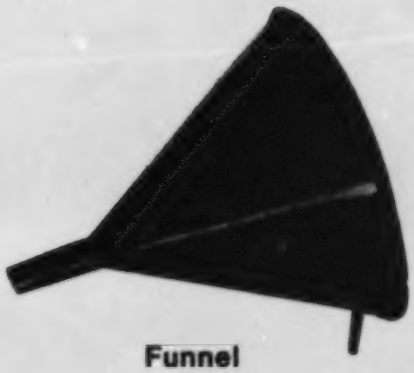
WHEN STORING AN ENGINE, REMOVE THE SPARK PLUG WIRE FROM THE SPARKPLUG SO THAT CHILDREN OR INEXPERIENCED PERSONS TRYING TO START ENGINE WILL NOT GET HURT

TM-20

51

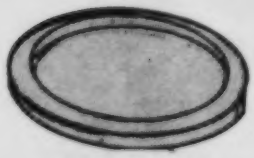
TOOLS AND EQUIPMENT FOR CHECKING OIL AND FUEL LEVELS

Oil Spout



Funnel

2 or 3 Clean Shop Towels



Plastic Lid

2 Cans of Motor Oil

Clean Gasoline in Approved Gas Can

TM-21

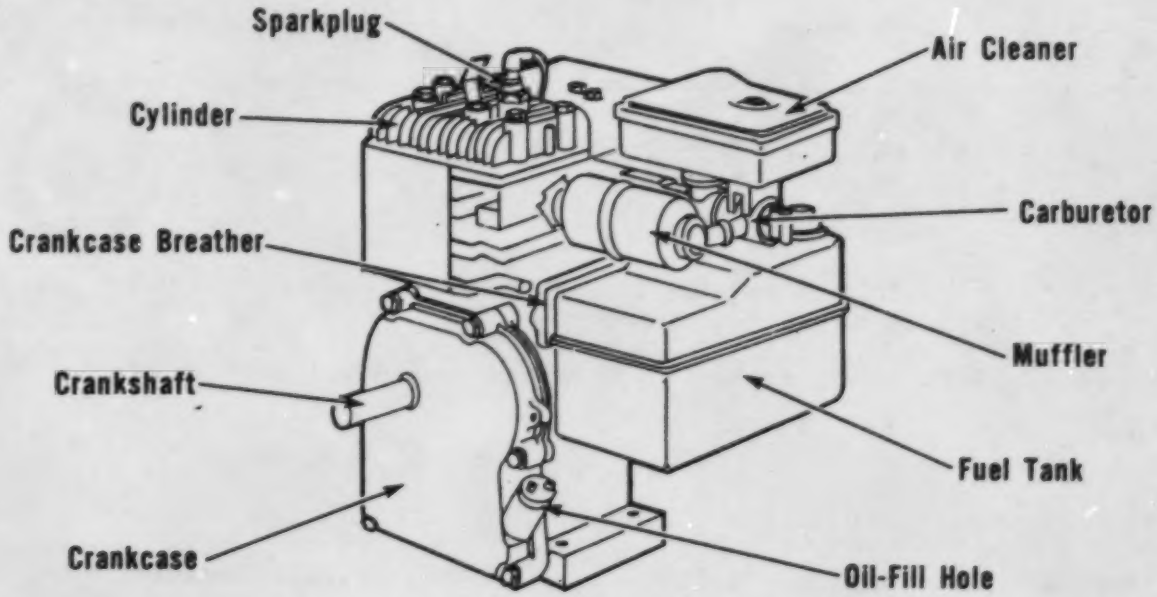
ANSWERS TO REVIEW MATERIAL IN THINGS FOR YOU TO KNOW

Page 4, Purpose of the Small Gas Engine: How Much Do You Remember?

1. F
2. T
3. T
4. F
5. T

Page 9, Small Gas Engine Parts and Their Use: How Much Do You Remember?

A.



B.
A. 6
B. 2
C. 5
D. 8
E. 7
F. 3
G. 4
H. 1
I. 9
J. 10

Page 14, Information on the Engine Nameplate: How Much Do You Remember?

A.
1. T
2. F
3. T
4. T
5. F
6. T
7. T

B.

INFORMATION FORM FOR ORDERING ENGINE PARTS

NAME OF ENGINE MANUFACTURER Briggs and Stratton

MODEL NUMBER 100202

SERIAL NUMBER 19165

Page 19, Information in Operator's Manual: How Much Do You Remember?

1. Starting and stopping the engine
2. Safety
3. Engine lubrication

Other possible answers: Adjustments, maintenance, other important information about the engine.

Page 21, 2 types of small Gas Engines: How Much Do You Remember?

1. F
2. F
3. T
4. T
5. T

Page 25, Identifying a 4-Stroke and 2-Stroke Cycle Engine: How Much Do You Remember?

1. 2-stroke cycle engine
   a. does not have oil-fill hole
   b. does not have an oil sump
   c. muffler is in center of cylinder
2. 4-stroke cycle engine
   a. has an oil-fill hole
   b. has an oil sump
   c. muffler is near head of cylinder

Page 30, 3 Operating Positions of the Crankshaft: How Much Do You Remember?

1. Multi-position
2. Vertical
3. Horizontal

Page 47, Safety to Follow: How Much Do You Remember?

1-13. Evaluated to the satisfaction of the instructor. Students should be able to state in their own words the safety rule for each picture.

Page 56, Good Work Habits to Follow: How Much Do You Remember?

A.

1.	C	6.	a
2.	b	7.	c
3.	a	8.	b
4.	c	9.	b
5.	b	10.	a

B. Evaluated to the satisfaction of the instructor based on individual student's participation in the discussion.

EVALUATION MODEL

Evaluation charts are found in the student manuals after each of the sections on "Things to Know," "Safety and Good Work Habits to Follow," and the two jobs. These charts are to be used by the teacher as a motivational aid and the students as a self-evaluation of individual progress toward the objectives.

The evaluation charts are designed around an evaluation model that includes the three major areas for vocational competency. These three areas are:

1. Demonstration of knowledge
2. Performance of job skills
3. Demonstration of safety and good work habits

Please note that although each of these three areas are of equal importance for vocational competency, the teaching and evaluating of safety and good work habits to special needs students cannot be overemphasized. Vocational failure of most handicapped students is frequently due to their poor personal and social development.

It is recommended that evaluation of each student's knowledge, job skills, safety, and work habits begin after the student fully understands what is expected and some achievement toward the objective is beginning to show. Because of this, the evaluation period will vary from student to student. Evaluation should last for a minimum period of two weeks or 10 consecutive school days. This length of time will allow most students to overlearn the objectives and thus achieve competency.

The rating scales for the evaluation charts are all similar. They are divided into 3 steps. Generally, these steps are:

RATING	MEANING
1 =	Does not reach the objective
2 =	Reaches the objective, but needs help or needs to be reminded.
3 =	Reaches the objective without help. Ready for job entry with shop supervision.

Criterion for competency or the rating that a student must achieve for a predetermined length of time is suggested to be a rating of 3 on the evaluation charts for three consecutive days. For example, when a student is able to demonstrate engine identification knowledge or perform safety, work habits, and jobs associated with engine identification without help for three consecutive days, then the student has reached criterion and is considered competent in that area.

ENGINE IDENTIFICATION: Check the Oil and Fuel Levels

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
1	(Start sound)	(Music up)
2	ENGINE IDENTIFICATION: Check the Oil and Fuel Levels	(Music under) Check the Oil and Fuel Levels One of the main reasons for an engine to run poorly or not at all (Music out) is that the crankcase oil and fuel levels are not regularly checked and clean, fresh oil and gasoline is not given to the engine when it needs it.
3	Cartoon slide: Lawnmower that is smoking and overheated because of lack of clean oil and fuel	Serious damage can occur in an engine if the oil level becomes too low in the crankcase, or the oil and gasoline are dirty or not the right type for the engine.
4	Dipstick showing oil level measure | View of fuel level in fuel tank with cap off	Before each operation of the engine, you will want to check the crankcase oil and fuel levels and if needed, add fresh, clean oil and gasoline. In this presentation you will learn how to do these two service jobs for a 4-stroke engine where the oil and gasoline are put into the engine separately.
5	Shop towels, clean motor oil, oil spout, funnel, clean gasoline in approved metal container, plastic top	First, you will want to gather all the supplies and tools you will need.
6	Motor oil, oil spout, funnel, plastic lid	For adding oil to the crankcase, you will need clean motor oil, an oil spout, a funnel, and a plastic lid for the opened can of motor oil, . . .
7	Gasoline in approved metal container with a spout and 2 shop towels	and for adding fuel to the engine, you will need fresh, clean regular-grade gasoline in an approved metal can with a spout. You will also need shop towels for wiping away dirt and cleaning up spills.

61

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
8	Lawnmower outside on level ground	To begin, move the lawnmower outside and on level ground so that you will get a correct oil and fuel level measure in the engine.
9	Shop towel wiping dirt away from oil-fill plug	Wipe off the dirt from around the oil-fill plug with a shop towel. This will help keep dirt from falling into the crankcase when the plug is off.
10	Fingers unscrewing oil-fill plug. Arrow pointing to left	Now, unscrew the oil-fill plug.
11	Dipstick coming out of crankcase	If there is a dipstick in the oil-fill hole, take it out.
12	Shop towel wiping dipstick	To get a correct oil level measure, first wipe the dipstick with a clean shop towel.
13	Dipstick going into crankcase	Then put the dipstick back into the oil-fill hole. Do not screw or snap on the plug.
14	Dipstick showing oil level below the "Add" mark	Again take out the dipstick and look at the oil measure on it. If the crankcase is full of oil, the oil level should be between the "Full" and "Add" marks on the dipstick. On this dipstick, the oil level is <u>below</u> the "Add" mark.
15	Oil level at threads of filler hole	If the engine does not have a dipstick, measure the oil level by looking in the fill hole to see if the oil comes to the top of the oil-fill hole threads.
16	Close-up of finger with dirty oil on it.	You will also want to check for dirty oil. If the oil is dirty, then its color will be very dark. There may also be small pieces of dirt or sludge in the oil. To check for sludge in the oil, dip your finger in the oil and rub your fingers together. You will feel any sludge on your fingers.

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
17	"CHANGE ENGINE OIL EVERY 25 HOURS OF OPERATION"	If the oil is dirty or the engine has been run for about 25 hours since the last oil change, you will want to change the engine oil.
18	Type and grade of motor oil is identified on engine nameplate	Before adding new oil, check the engine nameplate or an oil chart to make sure you are using the correct type and grade of oil for the engine.
19	Hand opening one of the cans with an oil spout	Now, wipe off the top of a new can of oil and open it with an oil spout.
20	Oil spout being placed in fill hole	Carefully place the oil spout in the fill hole and pour the oil into the hole. You may also use the funnel to help you pour the oil in the crankcase.
21	Oil level at top of threads on fill hole	Continue putting in new oil until it reaches the top of the fill hole threads . . .
22	Oil level at the "Full" mark on the dipstick	or to the "Full" mark on the dipstick. Don't overfill the crankcase because too much oil could be harmful to the engine.
23	Hand/shop towel wiping around fill hole	Wipe away any oil that spills around the fill hole and replace the oil-fill plug snugly in the hole.
24	Hand placing plastic lid on oil can	To protect the leftover oil in the can from dirt and moisture, place a plastic lid on the opened can of oil. These plastic lids can be found on cans of foods like peanuts, butter, or coffee.
25	Hand placing oil can on shelf	Always store any leftover oil in a clean, dry place so that it can be used at another time.

63

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
26	2-stroke engine close-up of engine nameplate	On 2-stroke engines, the oil and fuel are mixed and put into the engine together. Always check the engine nameplate or the operator's manual to learn exactly how to do this.
27	Shop towel wiping dirt away from fuel tank filler cap	Now, you will want to check the fuel level on the engine. First, wipe off the dirt from around the fuel tank filler cap.
28	Hand removing fuel tank filler cap	Remove the fuel tank filler cap. Remember not to smoke or light a match near the open fuel tank or fill a hot or running engine because gasoline can easily catch on fire.
29	Close-up of fuel level inside fuel tank	Look into the fuel tank to see if more gasoline is needed in the tank. Before operating the engine, you will always want a full tank of fresh, clean regular gasoline.
30	Dirty stick being placed in fuel tank. Big "X" across the stick.	When checking the fuel level, do not place a tool or stick in the fuel tank to check it because dirt from these things could easily drop into the gasoline and clog the fuel line or carburetor.
31	Hand screwing gasoline spout on the can opening	Now fasten the gasoline spout on the can of gasoline. Make sure the gasoline in the can is fresh. If it is stale, you can usually tell by its foul odor.
32	Gasoline spout in fuel tank opening	Carefully place the gasoline spout into the fuel tank opening and pour the fresh, clean gasoline into the fuel tank. Try not to overfill the fuel tank.
33	Shop towel wiping away spilled gasoline	If any gasoline is spilled on the engine or ground, wipe it away with a shop towel.

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
34	Hand replacing the fuel tank filler cap	Replace the fuel tank filler cap securely.
35	Hand replacing cap on gasoline can	Remove the gasoline spout, place it inside the gasoline can, and securely tighten the cap on the can.
36	Hand placing gasoline can on open shelf	Place the gasoline can in a cool, dry place in an opened room, away from heat where it could easily catch on fire.
37	Hand placing oily shop towels in metal container.	Now clean and replace the other tools that you have used in the tool room and put the oily shop towels in a metal container with a lid. Oily shop towels should not lay around the shop because they also may easily cause a fire.
38	Lawnmower that has stopped in the middle of a yard where the grass is half cut.	You have just learned all the steps in checking the oil and fuel levels and adding oil and gasoline before you operate the engine. Sometimes when operating the engine, it will be necessary for you to add more gasoline to the fuel tank.
39	Hand pushing lawnmower off-on switch to "off" position	When your engine runs out of gasoline, it is very important that you always stop the engine and let it cool off before putting more gasoline into the fuel tank.
40	Can of gasoline on fire	Remember, gasoline is very flammable and a gallon of gasoline that catches on fire could prove costly to you and others around you. (Music under)
41	(Credit slide)	(Music up and out)

ENGINE IDENTIFICATION: Start, Adjust, and Stop the Engine

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
1	(Start Sound)	(Music up)
2	ENGINE IDENTIFICATION: Start, Adjust, and Stop the Engine	(Music under) Start, Adjust, and Stop the Engine (Music out) As a small engine mechanic, you will need to know how to start, adjust, and stop different kinds of small gasoline engines.
3	2-stroke engine lawnmower / 4-stroke engine edger / 4-stroke chain saw / 4-stroke engine lawnmower	In this presentation, you will learn how to start, adjust, and stop engines with different kinds of choke systems.
4	"SAFETY FIRST"	Before attempting to start any small gas engine, there are some safety steps that should <u>first</u> be followed.
5	Mechanic reading operator's manual	<u>If</u> there is an operator's manual with the engine, a safety step to follow is to carefully read the manual to find out how to operate the engine and its controls.
6	Close-up of engine nameplate with starting procedures highlighted	Also read the engine nameplate, because sometimes the nameplate will tell you how to operate the engine.
7	Close-up of hand on stop switch on lawnmower	Another safety step to follow before starting any engine, is to know how to stop the engine. Find the <u>stop</u> switch on the engine and move it back and forth to see how it works.
8	Mechanic moving lawnmower outside	Now, to begin learning how to start, adjust, and stop the engine, move the engine outside to where it is well-ventilated. All engines, when they are running, give off poisonous gas called carbon monoxide that could make you ill if the engine is allowed to run in a closed-in shop. Carbon monoxide can also kill you if you breathe too much of it.

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
9	Close-up of engine on level ground	Make sure the engine is on level ground where it cannot roll away or turn over when you try to start it.
10	Close-up of oil-fill hole	Now, check the oil level and add more oil if needed.
11	Hand holding fuel-tank filler cap near fuel tank filler hole	Also check the fuel level and, if needed, add more gasoline. You will always want to operate an engine on a full tank of gasoline.
12	Shop towel wiping spilled gasoline from engine	If any oil or gasoline is spilled on the engine or ground, wipe it away with a shop towel.
13	Spark plug wire on spark plug and ignition grounding bar is off	Check the spark plug wire to see that it is securely on the spark plug. If there is an ignition grounding bar, move it away from the spark plug so that the engine will start.
14	View of underneath lawnmower and ground	Look under the engine to see that there are not any loose objects, like tools, sticks, or your feet that might get caught in the moving blades when the engine is started.
15	Fingers turning fuel shutoff valve to open. Arrow pointing to the right	If the engine has a fuel shutoff valve, turn the screw until the valve is completely open so that fuel can get to the engine.
16	choke control with the throttle control | manual choke control | automatic choke control	Now, choke the engine. There are several different kinds of chokes and you will need to be familiar with how to operate the different kinds.
17	Fingers pushing lever down	On this engine, the choke control is built in with the throttle control and is found on the handle of the lawnmower. To choke the engine, push the lever all the way down. When the engine starts, pull the lever up half-way.
18	Fingers pulling out choke	On this engine, the choke control is a push-pull type built directly into the carburetor. To choke the engine, pull the choke all the way out, and when the engine starts, push the choke in.

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
19	Close-up of carburetor, arrow pointing to automatic choke assembly	The choke on this engine is automatic. The operator doesn't have to do anything to choke the engine because while the engine is being started, the engine is automatically choked.
20	Arrow pointing to primer button	Some engines do not have a choke, but they have a primer. When this primer button is pushed down one or two times, extra gasoline is squirted into the carburetor, making the same rich fuel-air mixture that a choke does.
21	Hand moving throttle lever between 1/4 and 1/2 position	After the choke is closed or the carburetor is primed, set the throttle at about the 1/4 to 1/2 open position. Although most engines will have a throttle control lever, others will not, because the throttle will work automatically once it is started.
22	Fingers turning ignition switch to "on" position	If there is an ignition switch on the engine, turn it to the start or "on" position.
23	Engine with rope-rewind starter	Now you are ready to crank the engine. Four different kinds of starters are used on small engines, but the most popular type is probably the rope-rewind starter. In the rope-rewind starter, the rope will automatically rewind itself when it is pulled out and released.
24	Foot on lawnmower	To crank the engine with a rope-rewind starter, put your foot and some of your weight on the lawnmower so that when the rope is pulled, the lawnmower doesn't fall over.
25	Hand grasping T-handle	Firmly grasp the T-handle on the rope with one of your hands. Be careful not to put your other hand on the shroud, where your fingers might get caught in the moving flywheel.
26	Mechanic looking behind him	Now, look behind you to see if anyone or anything is near you. You want to give yourself plenty of room when pulling the starter rope so that you don't accidentally hit someone or something behind you.
27	Hand pulling out starter rope. Arrow pointing out	On the first pull, pull the rope out steadily and slowly until the engine comes to a compression stroke. When the engine comes to a compression stroke, you will hear the engine begin to sputter and you will feel some resistance when pulling on the rope.

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
28	Hand holding T-handle and rope out. Arrow pointing IN.	While holding on to the rope with your hand, slacken the rope and let it rewind.
29	Hand pulling out rope. Arrow pointing OUT.	Now, for the second or third pull, pull the rope out more firmly and quicker. Try not to pull the rope all the way out because there is a danger of breaking the rope.
30	Hand holding T-handle and rope out. Arrow pointing IN.	Again, hold on to the T-handle and let the rope rewind onto the pulley. If the rope is allowed to rewind without holding on to it, it could accidentally fly around and hit you, get tangled up on the pulley, or break the rewind spring in the pulley.
31	Hand pulling rope on chain saw that is laying on ground. Other hand holding down chain saw.	If you are starting a chain saw, be sure to lay the chain saw on the ground and hold it down with one hand while pulling the rope with the other hand. A chain saw that is cranked in the air could accidentally get out of control and cut your leg.
32	Hand opening manual choke	When the engine starts, push the choke in, if it is the manual type, . . .
33	Hand moving throttle to 1/2 speed	and move the throttle to about half-speed or to the "run" position on the throttle control lever. Never open the throttle all the way or gun the engine until it has a chance to warm up.
34	Engine that is idling	Let the engine run at this idle speed for at least one minute, so that the oil in the crankcase has a chance to warm up and lubricate all the engine moving parts.
35	Mechanic pushing lawnmower on grass	After the engine has warmed up, it is ready to work for you. This is called "applying a load" to the engine, such as mowing the grass, edging a lawn, or cutting wood. Apply the work load and gradually increase the engine speed as needed. Do not overload the engine by making it work too hard and too fast because this could quickly wear out the engine.
36	FOLLOW THESE SAFETY RULES	When making the engine work or applying a load to an engine, there are some safety rules that should be followed.
37	Cartoon slide: Lawnmower chasing mechanic, tools flying around.	One: Do not leave the engine running while you are not watching it or holding on to it. There is a danger of it getting out of control and hurting you or others.
38	Cartoon slide: Mechanic pushing smoking lawnmower uphill.	Two: Do not operate a 4-stroke-cycle engine at more than a 15-degree angle because there is a danger of starving it of the oil and fuel that it needs to run properly.

SLIDE NO.	SLIDE DESCRIPTION	NARRATIVE
39	Cartoon slide: Running lawnmower that is throwing off bolts, pistons, and others.	And three: If the engine is not running properly, stop it immediately and repair it. Even if the trouble is a minor problem, continuing to run the engine may lead to a more serious one that might be difficult and expensive to repair.
40	Hand moving throttle control to 1/3 speed.	When the engine has finished the work you want it to do, you should slow the engine speed to an idle, about 1/3 throttle speed. Let the engine cool for one or two minutes without working before you turn it off.
41	Cartoon slide: Lawnmower and mechanic cooling off. Heat and steam rising from both.	If an engine that has been working is suddenly stopped and not allowed to cool down, the moving parts will be stressed, which will cause them to wear out quickly.
42	Hand moving ignition switch to "off" position.	Now, to stop the engine, pull the throttle control lever to the "off" or stop position . . .
43	Finger pushing ignition grounding bar against spark plug.	or push the ignition grounding bar against the spark plug to stop the engine.
44	Finger turning fuel shutoff valve. Arrow pointing to right.	Now, close the fuel shutoff valve if the engine has one.
45	Fingers removing spark plug wire.	As a safety precaution against children or inexperienced persons trying to start the engine and getting hurt, it is a good idea to remove the spark plug wire from the spark plug. This will prevent the engine from acidentally starting.
46	Mechanic pushing lawnmower inside shop.	Finally, store the engine in a dry area, protected from wind, dust, and rain. If you do not plan to use the engine within about 30 days, drain the leftover gasoline from the fuel tank and carburetor. This will prevent the fuel system from clogging with gummy gasoline deposits.
47	Mechanic pushing lawnmower with big smile on face.	This completes the steps for starting, adjusting, and stopping a small gasoline engine. Correctly and safely follow these steps (music under) so that the engines you work with will last longer and give better service.
48	(Credit slide)	(Music up and out)

REFERENCES

A. Atteberry, Pat H. Power Mechanics. South Holland, Illinois: The Goodheart-Willcox Company, Inc. 1968.

B. Briggs and Stratton Corporation. Service and Repair Instructions. Milwaukee, Wisconsin. 1979.

C. Gray, James A. and Richard W. Barrow. Small Gas Engines. Englewood Cliffs, New Jersey: Prentice-Hall, Inc. 1976.

D. Herd, Amon. Maintaining Small Engines. Columbia, Missouri: Instructional Materials Laboratory, University of Missouri. 1981.

E. Hires, Bill, et al. Comprehensive Small Engine Repair. Oklahoma: Mid-America Vocational Curriculum Consortium, Inc. 1977.

F. Pipes, Ted. Small Gasoline Engines. Indianapolis, Indiana: Howard W. Sams and Company, Inc. 1973.

G. Roth, Alfred C. Small Gas Engines. South Holland, Illinois: The Goodheart-Willcox Company, Inc. 1975.

H. Stephenson, George E. Power Technology. Albany, New York: Delmar Publishers. 1973.

I. Turner, J. Howard. Small Engines: Care and Operation, Volume 1. Third Edition. Athens, Georgia: American Association for Vocational Instructional Materials. 1975.

J. Turner, J. Howard. Small Engines: Maintenance and Repair, Volume II. Third Edition. Athens, Georgia: American Association for Vocational Instructional Materials. 1974.